High Pressure Electrochemical Oxygen Generation for ISS, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

Giner, Inc. has developed an advanced high pressure electrochemical oxygen concentrator (EOC) that offers a simple alternative to the use of pressure swing adsorption (PSA) systems to generate high pressure oxygen for the International Space Station (ISS) and future human space flight applications. The high pressure EOC is based on proven electrolyzer technology demonstrated at Giner and delivers a continuous stream of dry oxygen with a highly controllable oxygen pressure (0-3600 psi) by feeding a low pressure humidified oxygen stream into the cathode side of the stack where oxygen is consumed. The generation of pure oxygen at 3600 psig is particularly applicable for filling tanks used for extravehicular activity (EVA). The benefits of using this technology rather than a standard high or large pressure differential electrolyzer stack include: 1.) significantly reduced membrane degradation resulting in an improvement in stack lifetime, 2.) increased safety as there is no risk of producing a combustible gas mixture in the event of gas crossover through the MEA, and 3.) simplified balance of plant (BOP) for the reason that typical liquid cathode feed electrolyzer stacks require sophisticated water management. Giner further simplified the high pressure EOC BOP by integrating a low pressure static vapor feed electrolyzer (SVFE) into a shared-end-plate stack.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: The proposed technology will take ambient air and water and deliver pure, dry high pressure oxygen at a rate of 0.9 kg/day at the end of Phase I. The high pressure achievable allows for both direct oxygen use and filling of oxygen life-support tanks. There are no other sub-systems necessary for this device and, obviously any NASA manned space mission could use this technology. As volumes would be low for NASA applications, Giner would work with a

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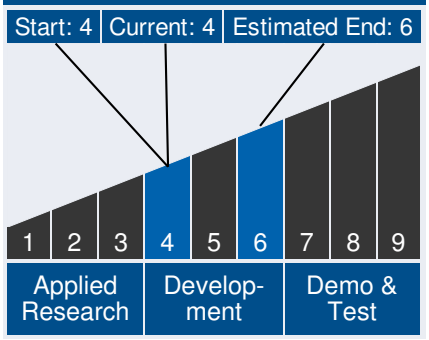
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

Continued on following page.

space system integration company to develop test and final space articles. Giner is currently working with Hamilton Sundstrand in the development of a simplified static feed oxygen generator for the International Space Station. A similar relationship would be pursued to deliver this technology to NASA Giner would also consider working with NASA to directly deliver the technology for NASA needs. In a parallel path to NASA?s needs, Giner has a relationship with other private sector space integrators such as Bigelow Aeropsace which may be interested in this technology as it matures. Today our interaction with these type of companies have only accepted high TRL level products to incorporate into their ongoing projects.

To the commercial space industry:

Potential Non-NASA Commercial Applications: Giner is very excited about a secondary application for the EOC, however in the field of organ preservation. Giner has come quite far in developing an organ transport and preservation system to maintain viability during transport by keeping the organ exposed to oxygen by persufflation, the passage of oxygen through the organs vascular system. Although this device uses an EOC, most of our work to date has concentrated on demonstrating the efficacy of the concept. The current NASA program will further advance the underlying technology, allowing us to increase reliability, while reducing mass; critical features for both applications. Underwater manned vehicles will be another secondary application and customer base that we would pursue, starting with Treadwell who currently serves the US NAVY, followed by Corac (ACI) who serve the British and French Navys, and ultimately offering to select private integrators for recreational use.

Management Team *(cont.)*

Principal Investigator:

- Meagan Rich

Technology Areas

Primary Technology Area:
Human Health, Life Support, and Habitation Systems (TA 6)
└ Environmental Control and Life Support Systems and Habitation Systems (TA 6.1)
  └ Air Revitalization (TA 6.1.1)

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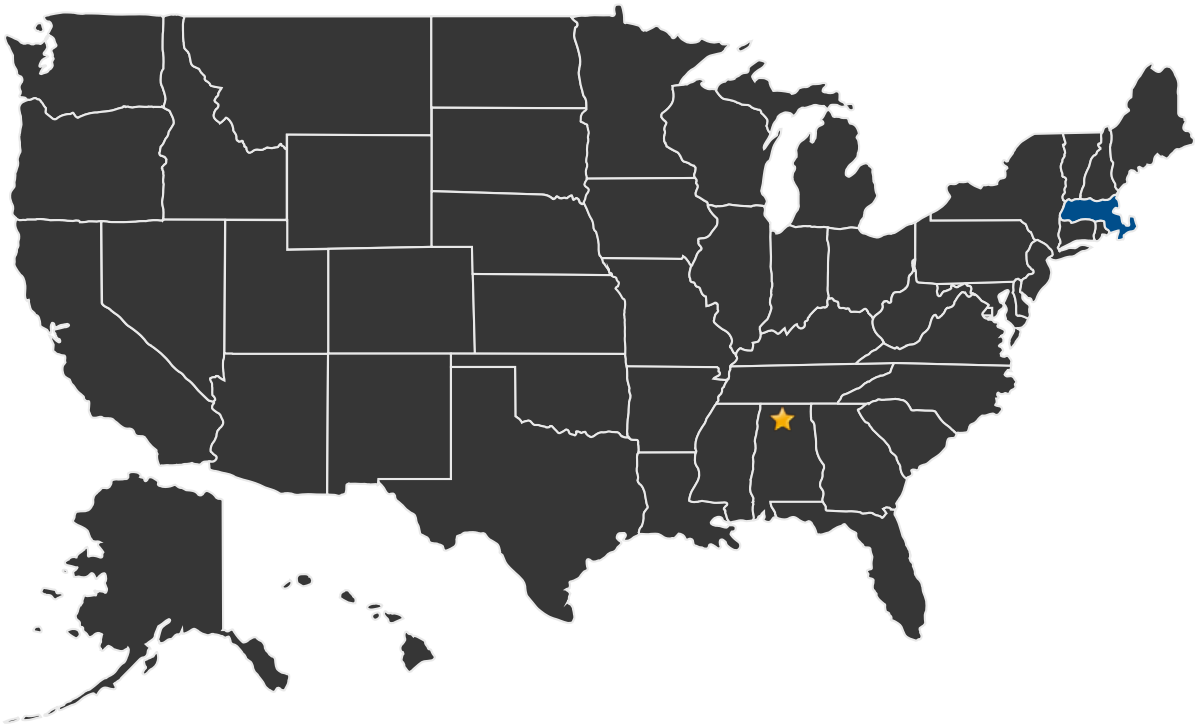
U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Marshall Space Flight Center

Other Organizations Performing Work:

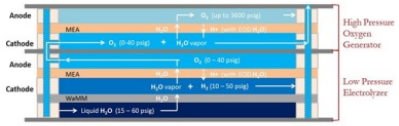
- Giner, Inc. (Newton, MA)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23430)

IMAGE GALLERY



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DETAILS FOR TECHNOLOGY 1

Technology Title

High Pressure Electrochemical Oxygen Generation for ISS, Phase II

Potential Applications

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